A CONTRIBUTION TO THE THEORY OF RAILWAY RATES.

In the volume supplementary to his history of English railway experience, Professor Cohn has put forth an explanation of railway rates which has won wide acceptance, and which deserves, both for its ingenuity and for the deservedly high reputation of the author, a more careful examination than it seems yet to have received.* Briefly, the theory is that railway charges are fundamentally like taxes. All experience shows that railway rates are based, not on the cost of furnishing the service, but on what the purchasers can afford to pay. As with taxes, the fundamental principle is that of *Leistungsfähigkeit:* the charge based on what the purchaser can afford to pay, and ought to pay. The problem, therefore, is at bottom one of ethics, involving those considerations of public policy and of right and wrong which recur in the discussions of proportional or progressive taxation. The need of considering the means and the purchasing power of the passengers and shippers forces itself on every railway manager, whether he will or no; and it supplies a striking illustration of the indestructible link between ethics and economics.

To illustrate by particulars. Cohn explains that the higher rates for first-class than for third-class passengers are not due to the more expensive accommodations of the former,— and here he is right beyond doubt, for the difference in expense would account for only an insignificant part of the greater charge,— but to the fact that their

*G. Cohn, *Die englische Eisenbahnpolitik der letzten zehn Jahre.* Leipzig, 1883. pp. 65-84.

means are larger. They can afford to pay more; railway managers feel that in justice they ought to pay more; and they are charged higher fares. Cohn makes no detailed application of this ethical point of view to freight rates, and his tentative style leaves it somewhat uncertain how far he would carry the principle. Indeed, there is an obvious difficulty here. It is true that freight charges are usually lower on cheap goods than on dear goods; but how are we to know that cheap goods — say, coal and ores — serve for the consumption of the poor? Cohn, however, expresses more than once his conviction that the fundamental question is the same,— one of justice and *Leistungsfähigkeit*. He cites, as a clear illustration, a provision of the German Constitution by which railroads are obliged, in times of scarcity, to carry food at low rates. Again, he notes that in regard to ordinary freight the means of the ultimate consumer are not easily ascertained: therefore, we have, in freight rates, only a rough and uncertain adaptation of the charge to his means, analogous to those common and unavoidable devices in taxation, by which we resort to some rough and more or less uncertain indication of the tax-payer's means. It suffices for his general conclusions that the adjustment of passenger fares on the basis of the means of the passengers, and of freight rates according to what the goods will bear, have something in common. Both sets of discriminations have an ethical basis: they rest on a sense of justice which the railway manager cannot put aside.

The conclusion finally deduced from this train of reasoning is that public ownership of railways, or at least public regulation of rates, is imperative. In every case where we find the price of a set of services inevitably settled on grounds of right and wrong, no private person or corporation can be safely intrusted with their administration. So delicate a process, involving necessarily an interference in distribution of a more or less arbitrary sort, must be in the hands of the State.

I have referred at some length to the speculations of the distinguished professor at Göttingen, because they are significant of a general trend of opinion among writers on railway topics, that the principles which apply to the ordinary phenomena of exchange do not help us in explaining the returns which a railway gets for its services. Sometimes this rejection of the general theory of value is stated in so many words. Sometimes it is rather implied, in statements that railway rates are governed, not by cost of service, but by value of service; by what the traffic will bear; by cost to some extent and by other things to a greater extent. The object of the present paper is to examine some of the characteristics of railway rates, and more especially to enter on the inquiry suggested by Professor Cohn's speculations, whether railway rates must really be explained on separate and peculiar grounds.

The central point in such an inquiry is the bearing of cost of service on railway rates. We may begin, therefore, with some consideration of the nature of a railway's expenses. Analyzing these, the most striking peculiarity is the great proportion of the total which falls to return on capital sunk. The investment of fixed capital is very large, not only in itself, but in comparison to the business done. There is a tradition in England that the turn-over of a railway — that is, its gross receipts — must be at least ten per cent. of the capital invested, in order to make the enterprise profitable; and in recent years the English roads have certainly not exceeded that proportion. Where the plant is less elaborate than in England, the gross receipts form a larger percentage of the investment. The roads of the State of Massachusetts have received in recent years in gross over twenty per cent. on the investment. But even at twenty per cent. the proportion of turn-over to capital is, in comparison with other industries, extraordinarily small. The consequence is that a very large proportion of the gross receipts must be devoted to the payment of a

return on capital at the usual rate. Return to capital thus forms by far the largest single item in the expenses of a railway. Operating expenses usually absorb from fifty to sixty per cent. of the gross receipts, leaving from forty to fifty per cent. for payments to capital. In the language of every-day life, we do not ordinarily speak of the whole of these payments as expenses: only the so-called "fixed charges" come under that head. But, for the purposes of economic theory, dividends enter into expenses as much as interest on debt, in so far as the dividends yield only that return which in the long run is necessary to induce the investment of capital. If the profits on investments in railways have not proved unusually high, and if dividends and interest combined have not formed an exceptionally large return on the capital sunk, we may say that the entire payments to capital form part of the expenses necessary for yielding the railway service. The evidence is strong that railways have not been, at least in England and the United States, on the whole exceptionally profitable. Certainly, they have not yielded returns to the investors so much above those got in other directions that there is any substantial inaccuracy in the statement that the forty or fifty per cent. of gross receipts which goes to interest and dividends is part of their necessary expenses. So much must be paid in the long run if railroads are to be built by private individuals, or by governments with capital borrowed from private individuals.

But this, the largest item in a railway's outgo, has no influence on railway rates: so much is admitted by all careful writers, and by all railway managers. The grounds of the conclusion are not always stated in the same way. Very often it is said that the investment in a railway plant is irrevocable; the railway is there, and cannot be moved or turned to other use; it will continue to be run so long as it yields anything over operating

expenses, whether or not the excess brings the usual return to the capital invested; this return, or the need of getting it, consequently does not affect rates. The reasoning holds good for a given road or group of roads at any particular time. But, looking at railroad operations as a whole, it hardly gives a sufficient basis for the sweeping proposition that railway services are rendered quite without regard to profit on capital. In the long run, even after admitting everything that may be said of speculative building and indirect profits of projectors, railroads will not be built and run unless the capital sunk in them gets something like the return it may expect in other directions. A road once built may be maintained and operated, even though it yields little or nothing on the capital sunk in it; but new roads will not be built or old ones extended under such conditions. Where we find the railway net steadily enlarging, new roads being built, and old ones adding branches, new tracks, and extensions, we may infer that the capital put into them expects to find and in the long run does find its account, and that rates are adjusted so as to yield to capital at least its ordinary return. Looking at the general range of rates as they develop in the long run, we cannot conclude, therefore, that return to capital may be dropped from the list of factors determining them.

But looking at any particular rate, at the charge on this or that item of traffic, we can reach the conclusion unreservedly; and this is the sense, to my mind, in which it is true and important that return to capital is not a factor in determining rates. As to any particular item of traffic, the only question is whether it pays more than the cost of moving it. If it does, the traffic is advantageous to the railway, even though the excess over operating expenses is so small that, if the same proportion held on all traffic, very little would be earned towards interest and dividends. It is a commonplace in the discussions of rail-

way rates that different sorts of traffic contribute in very different degrees towards paying fixed charges and dividends. Some classes of traffic, of the sort that can be got only if the rates are low, contribute little: others, of the sort that will come even though rates be high, contribute much. In the rates on one article of freight as compared with those on another, or in passenger fares as compared with freight charges, the item of return to capital is indifferent. Even though the traffic as a whole is mulcted enough to yield this return, the rate on any individual part is settled without regard to it.

Looking at the matter broadly, we have here commodities produced, in part at least, at joint cost. For the explanation of the values of commodities produced under such conditions, the classic economists developed a theory which they applied chiefly to cases like wool and mutton, gas and coke, where practically the whole of the cost was incurred jointly for several commodities. But obviously it also applies, *pro tanto*, to cases where only part of the cost is joint. The conditions for its application exist in any industry in which there is a large plant, turning out, not one homogeneous commodity, but several commodities, subject to demand from different quarters with different degrees of intensity. Under such circumstances, while part of the cost is incurred separately for the individual commodities, a part is incurred jointly for all of them. The nature of the demand, then, has a permanent effect on their values. No one commodity, of course, will be sold for less than the separate cost incurred in regard to it. Wool will not be sold for less than the cost of shearing, nor mutton for less than the cost of dressing; and in railroad operations no traffic will be carried for less than the separate cost of moving it. We may assume, for convenience in the present stage of the reasoning, that the several commodities in any one group — the several railway services in the group now under consideration — will

be sold at prices which will make up a total sufficient to yield ordinary returns on the capital embarked. There will remain then a gap between the prices which must be charged to get back the items of separate cost on each commodity, and the total price which must be charged to get a return on the whole outlay; this gap representing the elements of cost jointly incurred. To this joint cost, each commodity or service will contribute in proportion to the demand for it. It will contribute more and sell proportionately high if the demand does not need to be tempted by low prices, and will contribute less and sell proportionately low if a high price tends to choke off the demand. The familiar reasoning need not be further restated: we are concerned here not so much with the theory as with its application to the case in hand.* The labor which built the railway — or, to put the same thing in other words, the capital which is sunk in it — serves equally to aid in carrying on every item of traffic, and represents joint cost for the whole of it. The traffic, on the other hand, is of very various sorts, subject to demand from different quarters with varying degrees of intensity. It is, therefore, in accord with what we might expect from general theory that the different sorts of traffic contribute in very different proportions towards paying the fixed charges, or the return to capital,— the element in railway operations which represents joint cost. Traffic which will continue to come even at comparatively high rates will continue to be taxed high, and will contribute largely towards fixed charges. Traffic for which the demand is sensitive to price, and which can be got only at low rates, will contribute little.

The most complete illustration of a plant which serves to yield various services at joint cost is in a canal or common highway. Here the operating expenses are insignifi-

*The best statement of the general reasoning is in Mill's *Principles of Political Economy*, Book III. xvi. § 1.

cant, and interest on capital is almost the only current expense. We need not therefore be surprised to find that the canal and turnpike tolls of former days were not uniform, but varied with the character of the traffic. Canal tolls, like railway charges in our own day, were lower on the bulky goods, which would be offered for transportation only if rates were low, and higher on "merchandise" of greater value, which could bear a higher charge, and which railways had not yet diverted from the canals. Similarly, turnpike tolls, as Adam Smith tells us, were higher on carriages of luxury than on wagoners' carts.*

This application of the theory of joint cost has been explained at what may seem to be tedious length, because I believe that the same principle can be applied much more widely, and can be made helpful for the understanding of the bearing on rates of all the items of railway cost. Not only the fixed capital of a railway, but a very large part, in fact much the largest part, of the operating expenses, represents outlay not separate for each item of traffic, but common to the whole of it or to great groups of it. Operating expenses also form joint cost, and necessitate an accommodation of rates to demand rather than to specific cost. To the further consideration of this extension of the theory I now proceed, resuming for that purpose the analysis of the expenses of a railway undertaking.

The operating expenses of a railway are usually divided, in the best arranged reports concerning English and American roads, into five parts: (1) maintenance of way; (2) motive power; (3) maintenance of car equipment;

*See the foot-note to page 461. Examples of classified tolls on canals may be found in Ringwalt's *Development of Transportation Systems in the United States*, p. 47, and in Chevalier's *Voies de Communication aux États-Unis*, vol. i. p. 255. Compare Cohn's *Englische Eisenbahnpolitik*, vol. i. p. 15; vol. ii. p. 475. In Sax's *Verkehrsmittel*, vol. i. pp. 57–61, attention is called to the large proportion of plant in all transportation agencies, and to the element of joint cost in them. Here, as elsewhere in Sax's discussion, the principle of joint cost is rather implied than explicitly worked out.

(4) conducting transportation; (5) general expenses and taxes. In the appended note, the proportions borne by these items are given for some English and American railways.* It will be seen that by far the largest items are for motive power and for conducting transportation, each of which accounts for between twenty-five and thirty per cent. of the operating expenses. Next comes the item of maintenance of way; then, general expenses and taxes; last, maintenance of cars, which indeed is often classed, with good reason, among the expenses of conducting transportation.

But it is obvious that this analysis, interesting as it may be in showing the directions which a railway's outgo takes, helps little for the particular inquiry now in hand. It helps little in determining how far the operating expenses are jointly incurred for all the traffic or for great groups of it, and how far they are incurred separately for separate items of the traffic. Some items, to be sure, are obviously in the nature of joint cost. Practically, all of what goes for maintenance of way is of that sort. The wear and tear of road-bed, bridges, track, fences, is chiefly the result of the disintegrating forces of nature, and goes on whether there be much traffic, little, or none at all. Such an item as the wearing away of rails is indeed partly

*The figures given below are taken from the reports of the Union Pacific Railway and the Pennsylvania Railway (main line) for 1889, and of the London and Northwestern Railway for 1890. The figures state the percentage which the various classes of expenses bear to the total operating expenses. The classification of individual items is not the same for the three, though there is little difference between the Union Pacific and the Pennsylvania, except as to taxes. Between the English railway and the two American roads there are more important differences. But the figures are on a sufficiently uniform basis to serve for illustration of what is said in the text.

	Penn. R.R.	U. P. R.R.	L. & N. W.
Maintenance of way, ...	18.6%	18.1%	17.6%
Motive power, ...	26.6	33.1	26.2
Maintenance of cars, ...	15.0	9.5	7.1
Conducting transportation, . .	36.7	30.0	36.9
General expenses, ...	3.1*	9.0†	12.0†

*Not including taxes. †Including taxes.

the direct effect of the traffic; but it is impossible to apportion it in any measurable way to the particular items of traffic. For practical purposes, this item, like other expenditures for maintenance of way, is joint cost incurred for the traffic as a whole. The same holds good of the last set of expenditures, the general expenses for administration, insurance, legal expenses, and taxes (which, for the present purposes, we may consider to be "cost" as much as any other part of the railway's outgo). They are independent of the volume of traffic, and may be classed as joint cost. These two items — maintenance of way and general expenses — alone form about one-third of the total operating expenses. But, looking at the items which make up the other two-thirds, we find a great mass of expenditures similarly incurred for the traffic as a whole. Under the head of conducting transportation, or, in the English phrase, traffic charges, we have the expenses for switchmen and yardmen, telegraph expenses, many station expenses: practically all of them serving for the traffic as a whole. Under the head of motive power we have a large item for repairs of locomotives, and under that of maintenance of cars a similar large item for repairs of cars; both of them, it is obvious, due chiefly to wear and tear from the traffic as a whole, and not assignable to any particular part of it.

Professor Sax, in the chapter of his treatise on railways which discusses rates, has approached the problem from a point of view very close to that suggested in this paper, and has endeavored to ascertain how great a proportion of the expenses of a railway is independent of the volume of traffic. He distinguishes the "general" and the "special" costs; the former being of the expenses which must be incurred if the railway is to be operated at all, the latter those which depend more or less on the volume of traffic. He reaches, in the rough, the surprising result that the items of "general" cost constitute one-half of the

operating expenses. But operating expenses themselves are only one-half of a railway's outgo: the other half consists of return for capital sunk. Looking, therefore, at the whole of a railway's expenses, Sax concludes that three-quarters are independent of the items of the traffic. In other words, by far the largest part of the cost of performing railway service is joint cost.*

But this by no means states the full extent to which the principle applies. Sax includes among "special" costs every expense which is affected at all by the volume of the traffic. A large proportion of these more flexible expenses are not of a sort which can be split up and charged to any particular items or groups of traffic: they vary only with the volume of business as a whole, and not even in any fixed proportion as to that. Thus among Sax's "special" costs are included switching and signalling expenses, all station expenses, water supply, telegraph expenses, payments for damages, renewal and repair of rails. No doubt such expenses expand and shrink in some degree as the volume of traffic is greater or smaller; and, therefore, they may fairly be classed as of a less "general" sort than those for maintenance of way and return to capital, which must be incurred in order that there shall be any traffic at all. Yet, clearly, they cannot be apportioned to the different parts of the traffic. Switching and signalling expenses, for instance, tend to increase as traffic grows; yet it is impossible to say that any given train or any given branch of the traffic entails any specific part of the expense. So as to renewal and repair of rails. Heavier and more frequent traffic pounds the rails to pieces somewhat more quickly; but it is practically im-

*E. Sax, *Die Eisenbahnen*, Part 3, B, chap. ii. Practically the same proportion is pointed at by Kirkman (*Railway Accounts*, vol. i. p. 305), when he states that about three-fifths of operating expenses are incurred jointly for passengers and freight. It may fairly be inferred that most of the expenditures not assignable to one or the other of these great divisions are indispensable for conducting the traffic at all.

possible to say how much expense of the sort one train or a dozen trains entail. Figures are, indeed, sometimes given as to the average expense per train-mile for renewal and repair of rails. But, in calculating them, it is assumed, for example, that the greater speed of passenger trains offsets the greater weight of freight trains, and that a train-mile of either class can therefore be debited with the same share of this expense. The averages are purely fictitious. In fact, these expenses serve for carrying on the traffic as a whole: they cannot be charged to one part more than another. They may be classed, for all practical purposes, with those inflexible items which we have already found to constitute by far the larger portion of a railway's outgo. They swell still more the list of items of joint cost.

Even so, however, we have not stated fully the extent to which this peculiarity runs through a railway's operations. There are certain groups of traffic which entail separate and specific expenses for them alone; but there is again a large element of joint cost for the various services included within each group. The great groups are passenger and freight traffic. To each of these separately are chargeable certain expenses which, while not a large proportion of the railway's total outgo, are yet considerable in themselves. To freight service alone must be charged, for instance, wages of freight train-men and engineers, fuel, repairs of freight cars and locomotives, loss and damage on freight, station expenses incurred solely for freight. If there were no freight traffic, these expenses would cease; and, if a particular train were taken off, so much expenditure for wages and fuel would cease. But, obviously, for the particular train there is a large element of joint cost. A train of thirty cars may contain an assortment of various kinds of freight, coal and lumber, silks and sugar, for all of which there is one joint cost of train-movement. Further, for at least a large part of the

freight expenses as a whole, the same principle can be applied. A good share of the station expenses and of expense for repairs of equipment is incurred for the traffic as a whole, and cannot be split up among the separate trains and tons that go to make it up. So in regard to passenger traffic. Most of the station expenses and of the expenses for repairs of cars and locomotives are incurred for the passenger traffic as a whole. Others are partially separable. Suburban traffic and local traffic entail certain expenses of their own, and every train causes so much outgo for wages and fuel. But for the suburban traffic as a whole, again, many expenses are joint; and for any one train, which may contain through and local passengers, commuters and casuals, practically the entire expense is joint.

Attempts have indeed been made at various times, both by railway managers and by writers on railway topics, to apportion the expenses, and assign to each item of traffic the sums which it costs. Thus it is a common practice to assign the expenditures for maintenance of way to passengers and freight, respectively, in proportion to the train-mileage. The Interstate Commerce Commission has instructed the railroads of the United States, in their reports to it, to make an apportionment on this basis of their expenses for maintenance of way, and indeed for all items not separately chargeable to the one service or the other. Yet, surely, the division is purely arbitrary. These items of cost, in fact, are jointly incurred for both sorts of traffic; and I cannot share the hope entertained by the statistician of the Commission, Professor Henry C. Adams, that we shall ever reach a mode of apportionment that will lead to trustworthy results.*

*See the first annual report on the *Statistics of Railways in the United States*, 1888, p. 19. In the days before the Interstate Commerce Act was passed the practice varied. Thus the Pennsylvania assigned one-third of the joint expenses to passenger, two-thirds to freight; the Erie, two-fifths to passengers,

Again, Mr. Albert Fink has constructed an elaborate formula for ascertaining the cost of carrying freight per ton per mile. By this the cost of each of the great divisions of railway expenditures — maintenance of way, interest, station expenses, movement expenses — is separately calculated per ton-mile. The cost of maintenance of way per ton-mile, for example, is reached by assigning to freight traffic that proportion of maintenance expense which freight train-mileage bears to total train-mileage, and then dividing by the number of ton-miles of freight moved. Other items are similarly split up, and thus we get a final figure of "cost" per ton-mile,— which represents no real thing whatsoever. No one knows better than its able and ingenious author that it does not in the least show that each ton costs so many cents to carry, in the sense that, if the ton were not there, so much expense would disappear. Such calculations have their uses. Their results for successive years help to make more clear and specific the general tendency towards reduction in railway cost and rates. But the attempt to split up a railway's expenses in this way obscures the real nature of its operations; and, as a basis for fixing or criticising railway rates, the averages are useless and indifferent alike for the railway manager and for the student of economics.*

three-fifths to freight. Kirkman, *Railway Accounts*, vol. i. p. 314. In all cases the division is purely arbitrary, and, it is safe to say, is never thought of by any railway manager when considering at what rates he can afford to carry passengers or freight.

* Mr. Fink's formula is given in Ringwalt's *Transportation Systems*, p. 259. Compare the interesting analysis of the expenses of the Louisville & Nashville Railroad in his *Cost of Railroad Transportation* (Louisville, 1875), where an endeavor is made to figure out the operating expenses per ton-mile and passenger-mile. A similar careful endeavor is made for the Illinois Central in Mr. L. P. Morehouse's *Concerning the Cost of Transportation by Railroads* (New York, *The Railroad Gazette*, 1874). Mr. Morehouse goes so far as to divide the expense for maintenance of way into two parts, direct and indirect, the direct being those "due to the actual transportation" and the indirect those

The impossibility of reaching helpful results by investigating the specific cost of any item of railway service is nowhere better illustrated than in the curious assumptions of some European writers, who have tried to ascertain whether the fares for first-class and third-class passengers are justly apportioned to the costs of carrying the two classes respectively. In one such investigation, it was assumed at the start that a first-class passenger cost twice as much as a third-class passenger; then that a passenger car cost twice as much to move as a freight car; and, finally, that the difference in cost for different classes of freight and passengers corresponded to the differences in rates on them,— a veritable putting of the cart before the horse.* In another case, an English writer,† who wished similarly to ascertain the ratio of working expenses to gross receipts for first-class and third-class passengers respectively, began by apportioning the working expense to the different classes in proportion to the number of carriages of each class. But obviously, so long as the different carriages are always run together on the trains, this is a pure fiction. The case, in fact, is one typical of the impossibility of apportioning railway expenses. The

" due to the general operation of the road." His figures result in the following division of the maintenance expenses: —

	Direct.	*Indirect.*
Renewal of rails,	25 per cent.	— per cent.
Joints, spikes, frogs, switches,	7	—
Ties,	6	6
Labor on track, watchmen,	21	21
Repairs and watching of bridges,	4	8
Other items,	1	1
	64	36
	100 per cent.	

I cannot help suspecting that this apportionment between the direct and indirect expenses rests largely on guesswork; and I doubt greatly whether in practice the so-called direct share affects rates more than the indirect.

* The calculation is quoted in Schreiben, *Tarifwesen der Eisenbahnen*, p. 50.

† Quoted in Jeans's *Railway Problems*, p. 265.

items which are separable — such as the more expensive fitting of the first-class carriages — are insignificant. Wages of train-men and engineer, the only considerable remnant of expenses which can under any circumstances be separated from "general" costs, are here incurred for all three classes of passengers together. It would be difficult to find a more complete illustration of the application of the principle of joint cost.*

We may sum up the result of the preceding discussion as follows. The greater part of railway expenses is entirely independent of the traffic: it must be incurred in order to do any business at all. Of the remaining smaller part of the expenses, a large proportion consists of items which vary with the volume of the traffic as a whole. The rest contains items which, while confined to certain great groups, are yet incurred jointly for the traffic within each group. When we look at any particular carload or ton of freight, any particular passenger or group of passengers, we can find hardly an item of expense which is not incurred jointly for the entire traffic or for some large group of it. Meanwhile, as has already been noted, and as indeed is obvious, the services or commodities produced are not homogeneous: they are of very various sorts, and subject to demand from different quarters and with different degrees of intensiveness. Railways present on an enormous scale a case of the production at joint cost of different commodities.

The application of this conclusion is obvious. As with

* The scope for the operation of the principle of joint cost evidently is wider as a railway's traffic is more varied. It applies most widely to a great trunk line, whose traffic is in great volume and of heterogeneous character. On some of our Western roads, where one item — the through carriage of agricultural produce — forms a very large part of the total traffic, there is less play for its application. A road like the Reading, whose coal traffic is (or was) of preponderating importance, must get back from the coal tonnage some considerable contribution towards meeting the joint expenses. If a railway carried one commodity only, say coal, between two terminal points only, there would be no case at all for the principle.

all commodities produced at joint cost, demand has a permanent effect on values or prices (for the purposes of this investigation the terms may be used indiscriminately). We may continue to assume, as we did in discussing the mode in which return to capital affects railway rates, the conditions of free competition: that the total receipts of a railway will no more than repay the expenses,—return to capital being included among the expenses. Total receipts will then equal total cost. But that cost will be distributed among the different items of traffic according to the nature of the demand. Coal, lumber, ores, will be offered for transportation only if rates are so low that, if they were applied to the whole traffic, the enterprise would not pay. Nevertheless, if these articles yield anything over the separate expenses incurred for them alone, the road will take them, because the other expenses are incurred for the traffic as a whole, and will not cease if the heavy traffic is given up. Other goods, of greater value in proportion to bulk and weight, will be offered for transportation in much the same quantities, whether the rate be as low as on coal and ores, or a good deal higher; and they will be charged rates which, if applied to the traffic as a whole, would yield very high profits for the enterprise. We do not usually think of the demand for the transportation of coal as small, or of that for the transportation of silks as large; but in the sense pertinent for this investigation—sensitiveness to change in prices—the demands are small and large respectively. A considerable coal traffic can be got only at low rates: a considerable traffic in dry-goods will come even at high rates. Their cost is mainly joint, and the services will be sold at rates determined by the nature of the demand.

This seems to me to be the fundamental explanation of the classification of freight. All the early railroad tariffs were simple, and made little discrimination between different sorts of commodities. As time went on, experi-

ence forced on managers, whether in charge of public or of private railways, that adaptation of rates to demand which is the inevitable outcome of the peculiarities of the industry. In the early days of the Pennsylvania Railway, it was doubted whether the road could undertake to carry coal. It was argued that any freight which did not yield two cents per ton per mile must be carried at a loss. But a clear-headed officer pointed out that many general and constant expenses must be incurred, whether or not the coal was carried, and that the items which alone would be affected by the new coal business were comparatively small. The experiment was tried of carrying coal at what then seemed very low rates, and the traffic soon assumed large proportions.* In Germany, also, the early tariffs were simple; and the development of the system of classification was slow and gradual. In recent years, an endeavor has been made in the "car-space" or "natural" tariffs to return to the older and simpler way; and the virtual failure of the experiment supplies the latest illustration of the impossibility of fixing rates on the basis of the cost of the particular items of traffic. That tariff, first applied in Alsace-Lorraine, and afterwards extended to the adjoining parts of Germany, made a fixed charge for terminal expenses, and thereafter an equal charge per ton per mile on all goods. The reasoning was that dear goods cost no more to carry than cheap goods, and therefore should be charged no more. The vital mistake was the failure to perceive that neither dear goods nor cheap goods had, to any considerable extent, a separate cost of

*See the passages quoted in Ringwalt's *Transportation Systems in the United States*, p. 130. Coal traffic presents a case as little favorable to the application of the principle of joint cost as could be selected. Coal is carried in cars which are used ordinarily for no other traffic; and roads like the Pennsylvania carry the coal from the mines on trains which usually haul no other freight. All movement expenses and car-repair expenses are therefore chargeable separately and distinctly to the coal traffic. Yet even here the joint expenses so far outweigh that the key to the understanding of rates must be sought in the principle applicable to them.

their own. After a few years' trial, the system was superseded by what was called a compromise tariff, but was virtually a classified tariff, in which demand, and not an assumed cost, became the prime factor in rate-making.*

"Charging what the traffic will bear" is only a larger phrase for describing the general practice of which the classification of freight is a part. Wherever commodities are produced at joint cost, they are charged what the traffic will bear,— wool and mutton, beef and hides, silver and lead. We need not attempt to follow the principle to all of its applications,— to the rates on long-distance traffic as compared with short-distance traffic, to the rates on freight subject to competition as compared with non-competitive freight, to "back-loading" (a striking case of joint cost), to special and excursion rates in passenger traffic,— all of them cases in which the explanation of apparent anomalies lies in the fact that by far the greater part of the cost of rendering the service is incurred, not for the particular traffic in hand, but for the traffic as a whole. The fierceness of railway competition, due in part to the fact that the enormous plant is irrevocably committed to that particular business, is increased by the same circumstance. On competitive business, as on all business, the separable cost is small. Most of the expense of doing it is incurred, in any event, in the course of carrying on the transportation as a whole; and a railway will not retire from the competitive business as long as it yields anything above the small fragment of expense directly traceable to that particular traffic.

There is one further aspect of the practice of charging

* For the details, consult Ulrich's *Eisenbahntarifwesen*, and more particularly the passage at pp. 283–287, where Ulrich, himself much averse to "Werthclassifikation," yet admits the need, in the present compromise system, of a further step towards classification in the rates on freight in less than carload lots. The new tariff is called a "reform tariff," and did introduce reform in the way of simplifying the classification; but it is still a classified tariff,— that is, varies rates according to the nature of the demand.

what the traffic will bear of which a word may be said. That obnoxious phrase is used to describe two distinct things; on the one hand, the adaptation of rates to demand which results from joint cost; on the other hand, the adaptation to demand which results from monopoly. Thus Professor Hadley remarks that "wherever there is an industrial monopoly of any kind, there is a liability to discrimnations." * For simplicity of reasoning, it has been assumed, in the preceding paragraphs, that a railroad's business is carried on under the circumstances of free competition, and that therefore in the long run total cost determines total charges. But a railroad always has a monopoly as to some parts of its traffic; and, even where competition exists, it usually ends in combination of some sort, and in charges controlled only remotely and indirectly by competition. To the extent to which the element of monopoly enters, rates are again permanently affected by demand, or by what the traffic will bear. Any particular rate may be the result of the working of the two factors of monopoly and joint cost. The general range of charges on local traffic, for instance, may be determined quite without regard to cost or competition on the monopoly principle of getting the largest net return. The apportionment of these charges among the rates for different goods and from different places must be affected by the circumstances that all the transportation is produced, more or less, at joint cost. The traffic is charged what it will bear in two distinct senses.

Returning now to the main thread of the discussion, we may note some conclusions of practical importance which follow from the principle of joint cost. Obviously, there are peculiar difficulties in saying what is a "fair" or "reasonable" price for a commodity produced at joint cost with others. The Interstate Commerce Act prescribes that all charges shall be "reasonable and just";

* *Railroad Transportation*, p. 124.

and the Commission has been led by this provision, among others, to the slippery problem of directly fixing rates. If the government were to undertake to regulate the price at which pig iron or steel rails should be sold, the task would be difficult enough, but the guiding principle would be comparatively simple: let pig iron be sold for what it costs to make, "cost" including ordinary profits. But suppose it were attempted to fix the fair price for hides, horns, fat, rump, tenderloin? The complex conditions suggested by this question exist on a huge scale, in regard to railroad rates; and this even in the simplest case, where the total return got by a railroad in all its traffic is assumed to be determined by the total cost. When we bear in mind the actual situation in the United States,— on the one hand, the extraordinary complexity of the business, the constant transfer and rearrangement of industry, and the corresponding shifting in the demand for transportation; on the other hand, the monopoly element in a railroad's business, the extent to which many roads are in the position of rent-yielding natural agents, the enormous vested interests,— the difficulties of saying what are "reasonable" rates seem well-nigh insuperable. The Interstate Commerce Commission, in its interpretation of the phrase, has wisely refrained from putting the test of reasonableness in any assumed cost of services, and in practice has accepted the existing system of rate-making as on the whole reasonable.

These considerations do not show, nor are they here presented with any intention of showing, that public regulation of rates is impolitic or impracticable. But they may help to make clear how delicate and difficult a task the regulation of rates must be; and they seem to me to show clearly that, of the anomalies in railroad rates which are the subject of most complaint, some at least would not disappear under the most extreme form of public regulation,— State ownership and management. Professor Had-

ley has suggested that a government which should undertake to run a railway on the principle of tolls — that is, on the principle of charging for the transportation services what they cost — must arrange its rates in such manner that "each item of business shall bear its share of the fixed charges." * I would not speak otherwise than with high respect of Professor Hadley's contributions to the literature of railways; but in this case his conclusion, to my mind, does not follow. The general determination of rates on the principle of cost would make it by no means necessary that each item of traffic must pay its share or any share of the fixed charges. If a government tried to run its railways on such a plan, of apportioning the joint expenses equally among all classes and items of traffic, it would find that there was a large traffic, mainly of bulky goods and long-distance hauls, which its rates prevented it from getting; while yet it had incurred, whether this traffic came or not, by far the greater part of the expenses incident to it. The financial interest of the government would inevitably push it to making rates on this elusive traffic low enough to attract it: the traffic would be charged what it would bear. It is the nature of the industry which explains the fact, abundantly proved by experience, that government management does not lead to the disappearance of classification and apparent discrimination in rates. Further, it may be said that not only the financial exigencies of the enterprise, but the endeavor best to utilize the railway plant and labor, would lead to some such result. A government managing a railway system may be expected to consider, not merely how

* *Railway Transportation*, p. 250. But elsewhere, in speaking of the analogy of certain railway rates to the low price at which a manufacturer sells a by-product, Professor Hadley brings out clearly the principle of joint cost. *Ibid.*, p. 113, note. See also his remarks in the paper on railway statistics in the *Publications of the American Statistical Association*, New Series, No. 6. In Wagner's *Finanzwissenschaft*, 3d ed., pp. 291-296, substantially the same view is advanced as that of Professor Hadley, discussed in the text.

it is to get back the expenses incurred, but how it is to make the service most advantageous for the community at large. The best utilization of its service certainly could be secured only by charging on the slow-demand traffic the rates which would induce it to appear; while the expenses could be recouped only by charging on the other traffic the higher rates which it would bear. The principle of tolls, in sum, would no doubt lead a government system of railways to get back in the total income the total expenses incurred in rendering the services; but its own financial interests and the general interests of the community would lead it to refrain from distributing the fixed charges and other joint expenses among the various items of traffic on any rigid scheme.

We may return now to the point at which we started, and consider again Professor Cohn's speculations as to the characteristics of a railway's operations. If the reasoning presented in the preceding pages is sound, obviously his conclusions are not tenable. If the true explanation of the apparent anomalies in the adjustment of railway rates is to be sought in the principle of joint cost, the ethical principle of *Leistungsfähigkeit* may be brushed aside, and the analogy to taxation disappears. The whole train of reasoning is doubtless but a phase of the general reaction in economics. The attempt to draw a sharp line of distinction between ethics and economics has led to a counter-disposition to bring in the ethical element at every possible point of contact with economic discussion, with results, in this case at least, that are not helpful for a true understanding of the phenomena. No doubt a railway, whether in the hands of a private corporation or of the State, might fix its rates, if it chose, on some basis of justice. There is an industry, nowadays always in the hands of the State, in which some effects of public policy, as distinct from mere business expediency, can be readily seen. This is the postal service, in which the rates on printed

matter, low as compared with those on written matter, are the result, in part at least, of general policy. No doubt the fact that the cost of carrying the printed and written matter is largely joint, helps in explaining the apparent anomaly; but the educational advantage of the community has been the main motive for the low postage on printed matter. The case is indeed one in which the motive is a general one of public policy rather than an intention of lightening the burdens of the poor; but the motive is different, and the explanation of the varying prices different, from those which we should find in the usual phenomena of exchange. But with railway rates the case is different. I trust I have succeeded in showing that the main peculiarities in railway rates, those which have appeared under government management as well as under private management, are not to be explained on a supposed basis of justice and right, by which the well-to-do are charged high, and the needy are left off easily. One might as well say that the prices of rump steak and of tenderloin were fixed as a matter of mercy on the poor consumers of rump and of tax on the rich consumers of tenderloin, and argue thence that, since the delicate business of adjusting this apportionment could not be intrusted with safety to private persons, the State should take into its hands the business of cattle-raising. If the explanation of railway rates from *Leistungsfähigkeit* is untenable, the particular argument for government ownership which rests on it must also go; and to my mind the case for public management is not much weakened by the loss.*

* Cohn refers to the tolls of the old turnpike companies as illustrations of his principle, and calls attention to a passage in the *Wealth of Nations* (Book V., chap. i. p. 326 of McCulloch's edition) in which Adam Smith says: "When the toll upon carriages of luxury, upon coaches, postchaises, etc., is made somewhat higher in proportion to their weight than upon carriages of necessary use, such as carts, wagons, etc., the indolence and vanity of the rich is made to contribute in a very easy manner to the relief of the poor by rendering cheaper the transportation of heavy goods to all the different parts of

No doubt it is often said in popular discussions — Professor Cohn takes pains to cite utterances of the sort — that it is "right" that expensive goods should pay high rates, and cheap goods low rates. But such phrases are only a part of the disposition, common among those untrained in economic reasoning, to accept as right and just that which has worked itself out in the long run from the play of ordinary economic forces. They are like the phrases that fair wages and fair profits should be allowed, which at bottom mean nothing more than usual wages and usual profits. The true explanation of classification based on the value of the goods is simple enough: on goods that have high value for little bulk and weight, a given charge of so much per hundred weight will usually have much less effect in checking traffic than the same charge on goods of great bulk and low price.

Sometimes, indeed, the common though not necessary connection between the value of the goods and the rates charged on them has led to statements that assume a more scientific form. Thus it has been laid down that the true principle governing railway rates is not cost of service, but "value of service." A recent expression to this effect

the country." "Here, then," comments Cohn, "in Adam Smith, the greatest authority of orthodox economics, we find expression of the view, nowadays opposed as a 'new-fangled theory,' that it is just to consider the means of the persons using a highway and to apportion amongst them on that basis the total expenses of the highway." *Englische Eisenbahnpolitik*, p. 68. But the paragraph quoted by Cohn from Adam Smith is open to the same difficulty as Cohn's own attempt to explain, on principles of justice, low railroad freights on bulky goods: are not the bulky goods as likely to be used by the rich as by the poor? Elsewhere, however, Adam Smith notes the peculiarity of beef and hides, mutton and wool, as commodities having a joint cost. "The price of both great and small cattle which are fed on improved and cultivated land must be sufficient to pay the rent which the landlord and the profit which the farmer has reason to expect from improved and cultivated land. If it is not, they will soon cease to feed them. Whatever part of this price, therefore, is not paid by the wool and the hide must be paid by the carcass. The less there is paid for the one, the more there is paid for the other." Book IV. chap. viii. p. 294. In this passage, and in others of similar tenor (*e.g.*, Book I. chap. xi. pp. 106, 108), Mill probably got the hints for his more elaborate discussion of the principle of joint cost.

is in Professor Seligman's valuable articles on the Interstate Commerce Act; and the Interstate Commerce Commission itself has frequently given emphasis to value of service as its test of the reasonableness of rates.* So far as the phrase is a convenient mode of stating to the general public the consequences which flow from the element of joint cost in railway services, and of calling attention to the inevitable effects of demand on rates, it may be useful. But surely it gives no real help towards solving the difficulties of the problem. It cannot mean that rates are based on the value in use, or the intrinsic utility, of the service. On that ground, grain and coal presumably would be charged higher rates than silks and spices. If it means that rates depend on the value of service in the sense of its value in exchange, we are confronted with the obvious difficulty that the rates *are* the value in exchange of the service. The explanation then says simply that charges are determined by what is charged; which does not much advance matters.

The explanation from joint cost, which is put forward in this paper as the key to many of the apparent anoma-

*Professor Seligman's statement is in the *Political Science Quarterly*, vol. ii. p. 330. The "value of service" idea is not a new one: it appeared in some of the earliest discussions of railway rates. The most earnest appeal to it as the one explanation of railway rates is in La Gournerie's *Etudes sur l'Exploitation des Chemins de Fer*, p. 117 and following. A characteristic passage from the Interstate Commerce Commission's opinions is the following: "The value of service is generally regarded as the most important factor in fixing rates. It furnishes, theoretically at least, a foundation for an equitable apportionment that takes into account all interests,—those of the carriers, the owners of the property carried, and the public,—as well as the dissimilarity of the merchandise. . . . The value of service to a shipper, in a general sense, is the ability to reach a market and make his commodity a subject of commerce. In this sense, the service is more valuable to a man who transports a thousand miles than to a man who transports a hundred miles, so that distance is an element of the value of service. In a more definite and accurate sense, it consists in reaching a market at a profit, being in effect what the traffic will bear to be remunerative to the producer and dealer. If the charge for service leaves no profit to the shipper, the traffic is worthless, and necessarily ceases." 2 *Interstate Commerce Commission Reports*, 636. Compare similar passages in *Ibid.*, 474, 545. Nothing could illustrate better the hopeless confusion to which the supposed principle leads.

lies in railway rates, is applicable not only to the great and conspicuous case of railways, but to many other industrial operations. The practical importance of the theory of value which rests on production at joint cost, becomes greater and greater with the general tendency to use a large plant for varied purposes, and with that better utilization of products formerly waste which results from the advance in the arts. Cotton, cotton-seed oil, and cotton-seed cake; beet-sugar and beet-cake; the various articles into which coal-oil is converted; silver and lead from lead ores,— these are familiar illustrations. Some other cases which, like railroad rates, have puzzled writers on economics, can be referred to the same principle. The prices charged to the play-goers for opera chairs, seats in the pit, and gallery standing-room have been discussed, as if they were quite anomalous, and inexplicable on the general theory of the bearing of cost on value. Similarly, the relative prices of first-floor and fifth-floor apartments have proved puzzling. Obviously, the element of joint cost is largely present in these cases; and the principle helps to clear up such real difficulties and anomalies as they present.*

In conclusion, the reader may be reminded that this paper makes no pretence of considering the problem of railway rates in all their bearings. To explain all the phenomena, or to say the last word on the subject, would require a more exhaustive and difficult discussion. Other considerations than those which flow from the fact of joint cost must then receive their due weight. The enormous fixed capital and the consequent impossibility of retiring from the enterprise if it becomes unprofitable, the greater or less degree of monopoly, the wide gulf between railway managers and investors, sometimes leading to consequences

* The cases last mentioned are referred to by Professor F. J. Neumann in Schönberg's *Handbuch der politischen Oekonomie*, vol. i. pp. 230, 233 (1st ed.). The explanation suggested in the text does not seem to have occurred to this ingenious writer.

of its own,— these and other elements are to be taken into account. The circumstance that the various services are rendered mainly at joint cost is only one of those in which railways differ from most industries. But it is one whose effects ramify into every part of a railway's operations. When we discuss the effects of any one of the other distinguishing features, such as the enormous and immobile plant, the working of competition, the effect of monopoly, we must bear in mind that there are always present the modifying effects of the principle of joint cost. At the same time this important peculiarity of railway operations, like most of the differences which they present from the conditions of other industries, is a divergence in degree rather than in kind. It is extreme, but not anomalous. Railway rates need not be detached from the general phenomena of exchange and set apart as explicable only on grounds of their own; and the main object of the present paper is to make some contribution towards determining their proper place in the theory of value.

F. W. TAUSSIG.